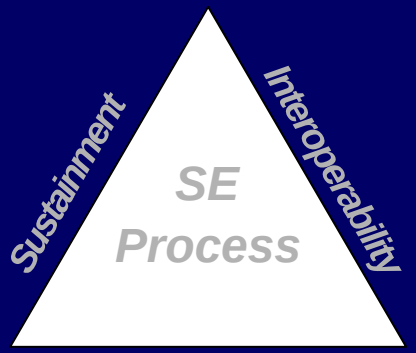
Certified
Naval Battle Groups



Optimizing Manpower and Maximizing Effectiveness through Warfighter Centered Design

Christi Adams
Naval Surface Warfare Center, Dahlgren, Virginia

NDIA System Engineering Conference Oct 21-24 2002

Problems of Today

Poor Design Impacts…

Operations, Maintenance, Logistics, Safety

Training, Morale, Recruiting, Retention, Quality of Life…

Knowledge & Decision Superiority

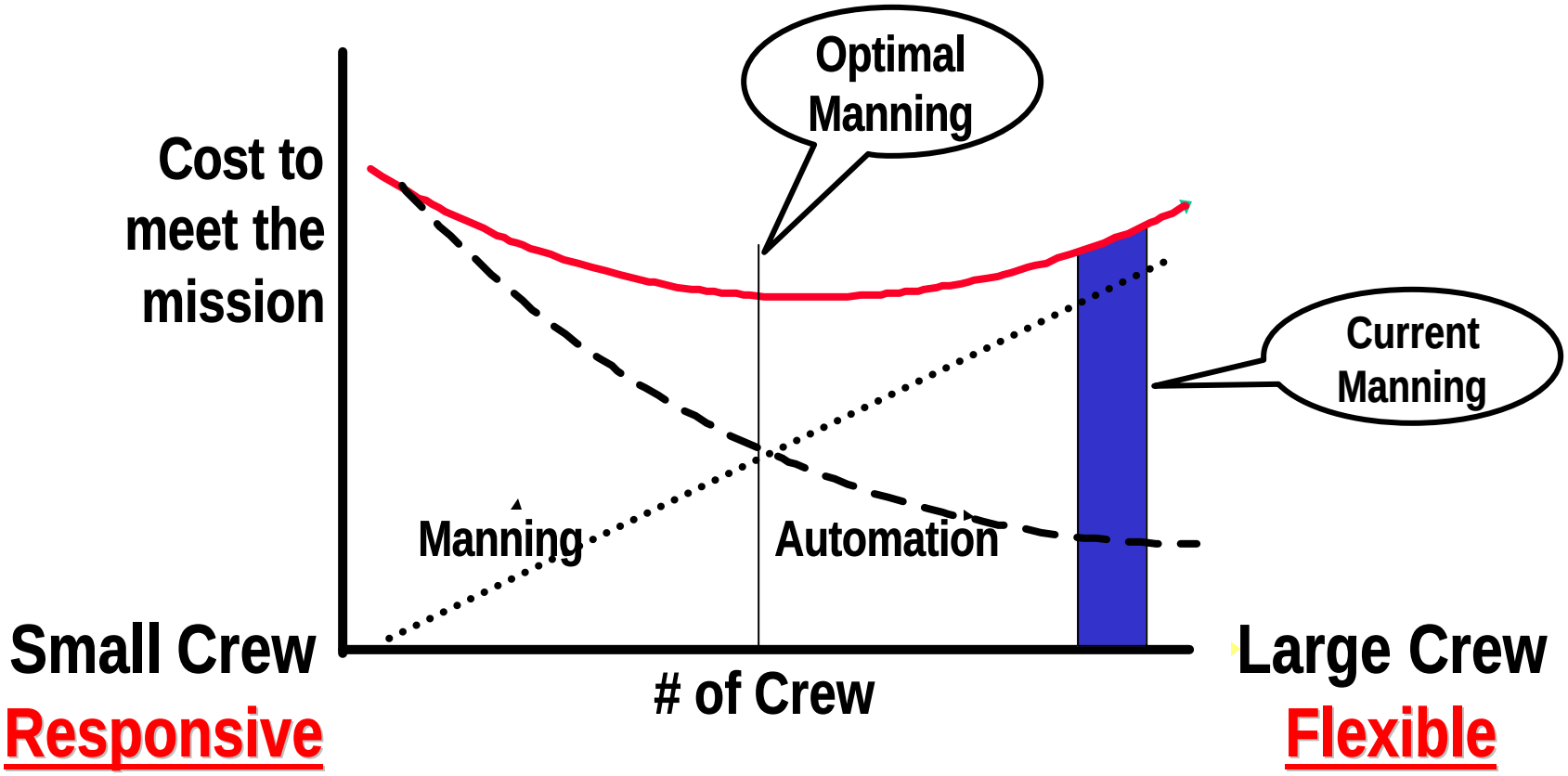
Our Ability to Know, Fight, and Win

How do we change this?

- Apply our understanding of…
  - Human Capabilities and Limitations…
  - How technology can benefit, impact…how it should be applied…
- Follow a structured systems engineering process

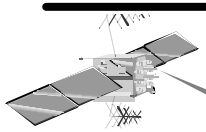
On Time, Within Budget, Meeting the Needs

Optimal Manning



↑Total System Performance and Life Cycle Cost ↓

Knowledge Superiority



National assets

TACAIR

LAMPS

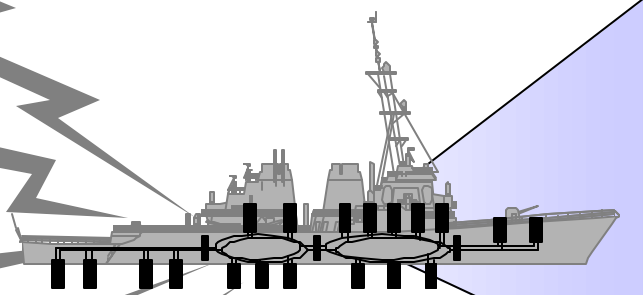
Ground-based C2

Link-16

AWACS

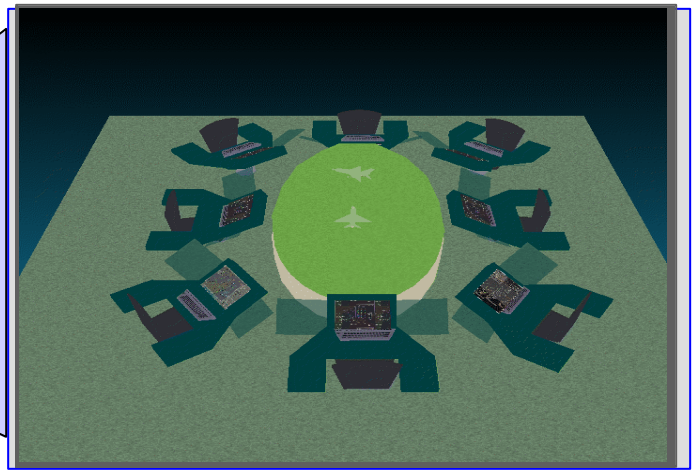
CV

CONNECTIVITY



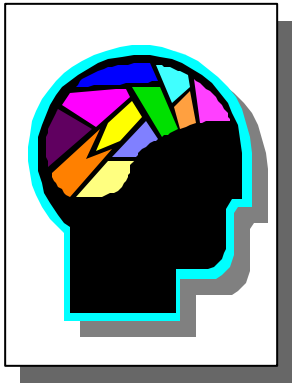
COMPUTING INFRASTRUCTURE

DISPLAY TECHNOLOGY



If implemented properly, provides…..

KNOWLEDGE

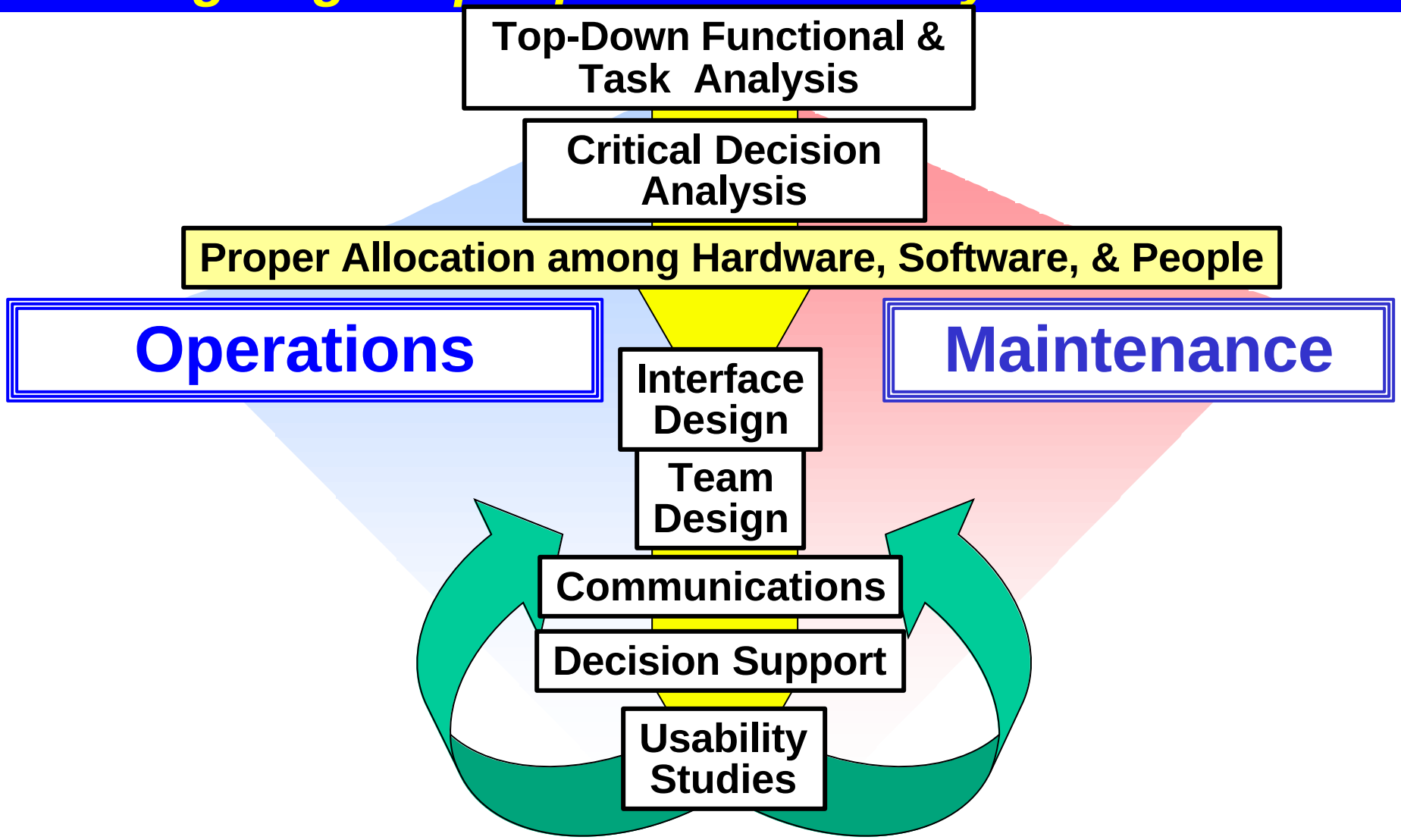


UNDERSTANDING

Timely & Effective Decisions

Warfighter-Centered Design Approach

Designing for people as critical system elements



Warfighter Centered Design Approach

Warfighter Involvement Throughout…

Key Areas and Influences on Performance and Cost

Rotation Strategy

Cultural Acceptance

Shore Support

Crew Deployment

Policy Change

Career Progression Strategy

Training Strategy

Skill Level Mix

Rating Consolidation

Work / Rest Fatigue

Close-loop Detailing

Staffed w/ 100% of billets

2008 and Beyond Workforce Recruiting

Human Performance Constraints

Cost

Quality of Life

Rapid Technology Upgrades

Mission Capability and Flexibility

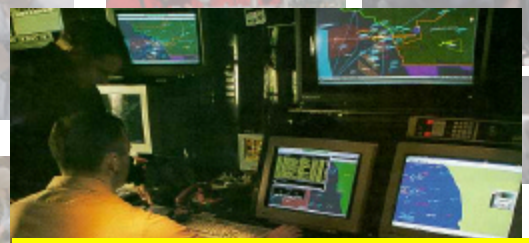
Contact Relief

Examples


Manning Affordability Program:
AEGIS Comparison Manning Reduction
Communications Study

Manning Affordability Program

Job Design



Program Executive
RDML C. Hamilton
Program Manager
RDML T. Bush
Project Manager
Mr. R. Bost, PEO (S)

Process

Enable at least a 2-to-1 combat systems manning reduction with sustained performance

HUMAN Performance Models and Metrics

www.manningaffordability.com

Office of Naval Research

PEO(S)

DD21

NAWCTSD

NAVSEA Dahlgren

ATRC

NRL, NSMRL

SPAWAR

APTIMA

BCI

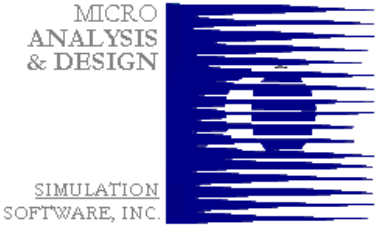
CHI

MAAD

PSE

RAYTHEON

ACS/Synetics SARNOFF



Human Centered Design

Results of Designer Task Analysis and new Human-Centered Design process have been approved and incorporated into the following standards and documentation...
(all funded & maintained by external sources)

IEEE 1220 Systems Engineering Standard, 12/99

ISO 15288 International Standard for System Life Cycle Processes Comments Approved for Update in 01

Human Engineering Chapter for "International Encyclopedia of Ergonomics and Human Factors", 6/00

International Council on Systems Engineering (INCOSE) System Engineering Handbook, Appendix on Human Engineering, 12/00

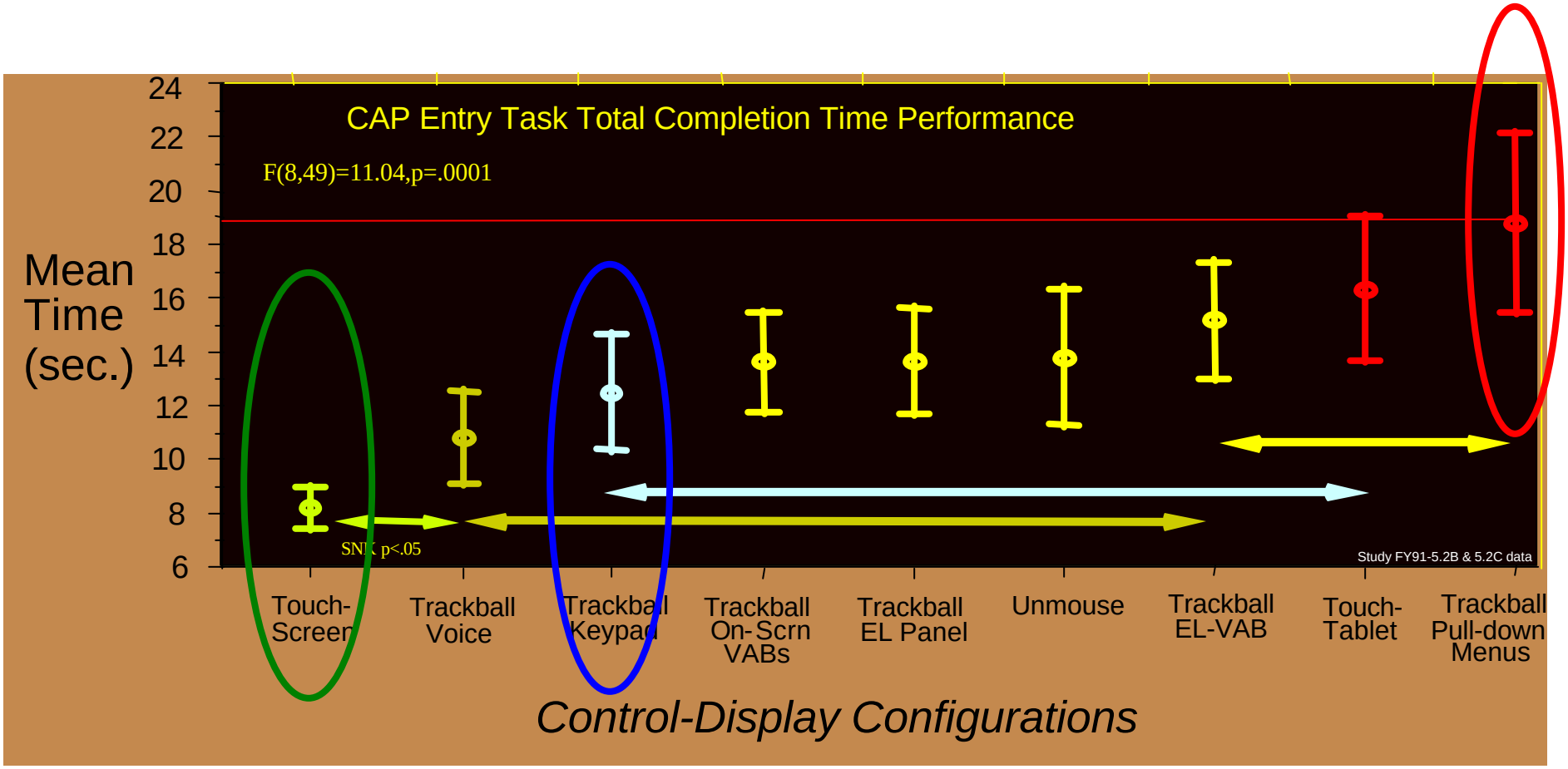
Manning Affordability Web Resource for Designers - linked from DD21

Capability and Maturity Model (CMM) for Systems Engineering

Institutionalize the Process

Example: Consoles

Example: Controls



Manning Affordability Goal

Demonstrate that
human-centered design
approach & advanced multimodal
technologies
can support a 50% manning reduction
for CIC Air Defense Warfare

Performance must be equal to or better than with current designs

Fleet Testing is Critical!

INDIVIDUAL USABILITY TESTING

TEAM TESTING - ADW

SWOS Newport

Norfolk VA
Wallops Island VA

San Diego

Dahlgren

Team Testing Phase I
Aegis Teams-Existing HCI

Team Testing Phase 2 Fleet Teams in ICE

Comparison Study Results:

- On a subset of ADW functions, Build 1 allows 50% reduction in team size with
  - performance equal to or better than Aegis teams
  - lower perceived workload
  - better Situation Awareness and Assessment

Positive Impact on Warfighter Performance w/50% Manning Reduction & very limited training

Example: Communications

Enable future Naval operators to handle required comms circuits, while <u>simultaneously performing primary warfighting tasks</u>

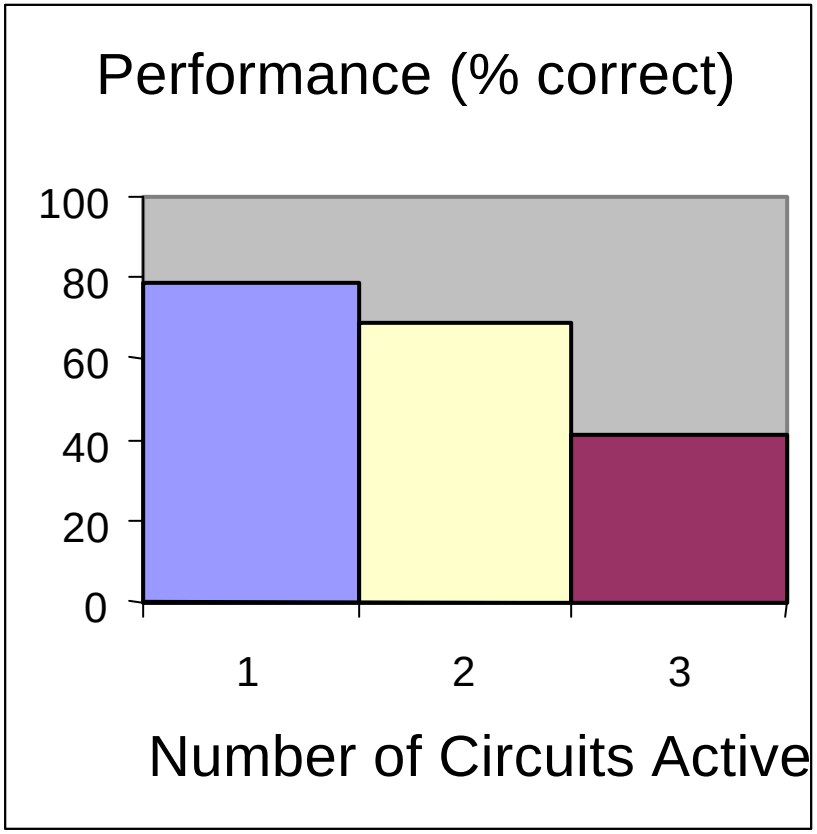
Results
(# of Active Circuits)

Expectation:

- Performance will decrease as active circuits increases

Finding:

- Performance drops significantly at 3 concurrently active circuits



Performance only 80% with just one circuit

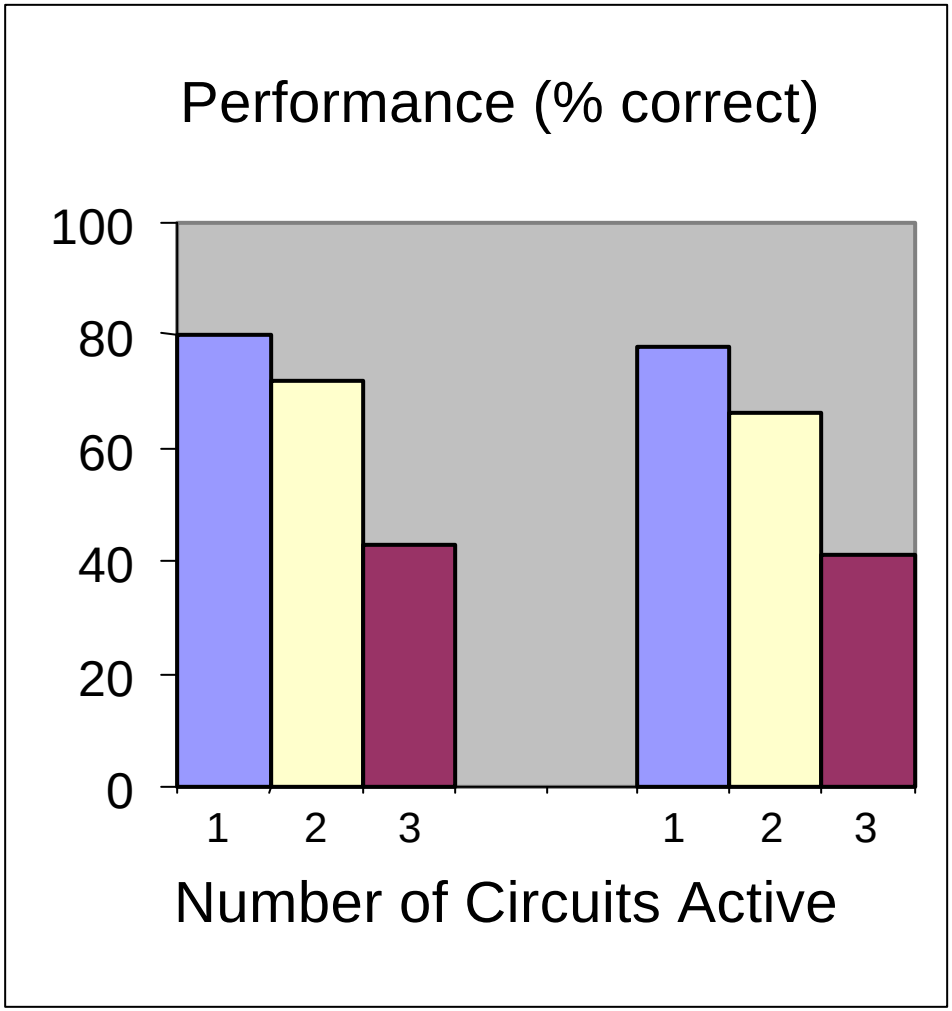
Results
(Speech To Text)

Expectation:

- Speech-to-text window will improve performance

Finding:

- There is no measurable performance difference



ICE Human Performance Assessments

Integrated Command Environment (ICE)

Validated Concepts
Warfighters/Industry/Academia
S&T/R&D/Systems

Decision Superiority

Knowledge Superiority

Communications

Manning Optimization

Flexibility

Redundancy

Technology

ICE Products

- Concept Demonstration
- Design Development
- Performance Assessment
  - Tactical Command Focus
  - Individual & Team
- HSI Research
- Standards / Training
- Human Performance Models
- Exercise Node

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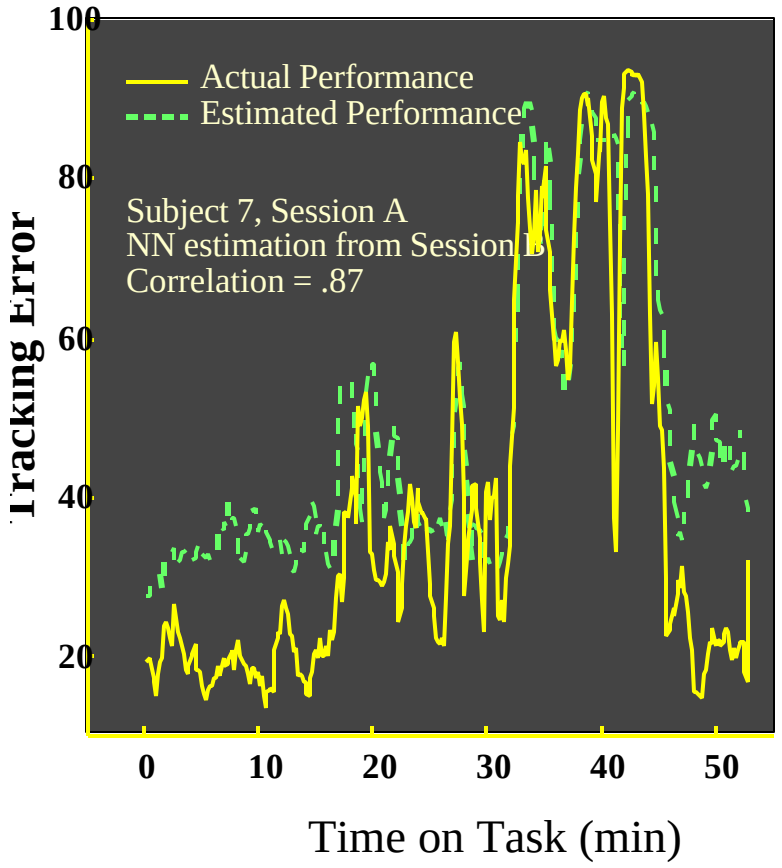
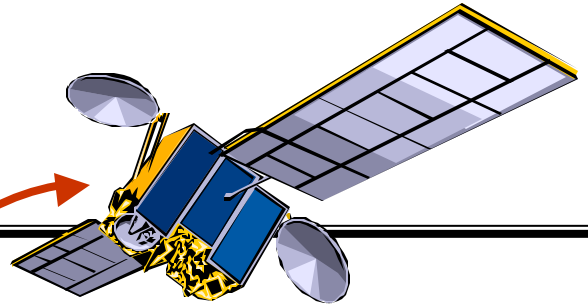


ICE Products



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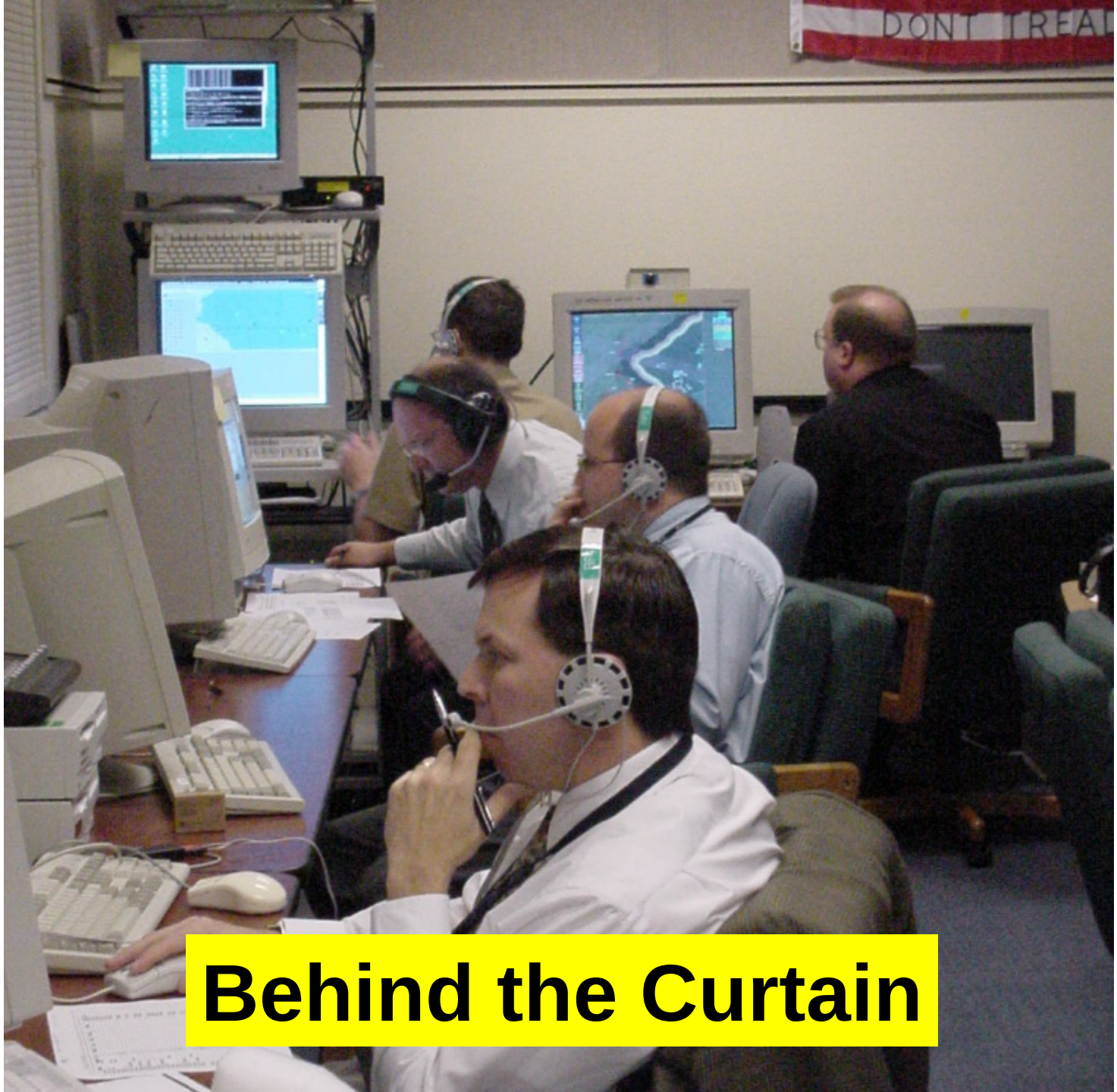
NRAC 2001 Technology Insertion Panel recommends ICE as Center for Human Factors Issues

Real Warfighters
Realistic Tests

Test Event


Test Event


Behind the Curtain

Data Recording

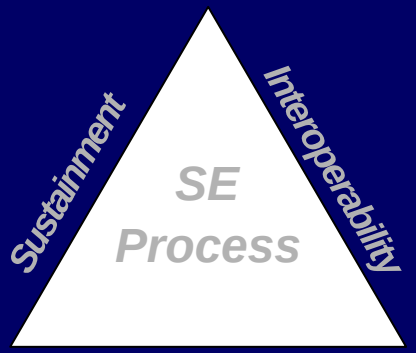
DEBRIEF

Warfighter Centered Design

- New Engineering Process
  - Treat Human as Integral Part of the System
- Advanced Engineering Environment
  - Develop Human Engineering Tools / Policies / Standards / Prototypes
  - Integrate Hardware / Software / Human Engineering Disciplines
- Performance Testing in Realistic Environments to Validate Designs

The Sailor
Is Engineered Into the System
From the Beginning

Certified
Naval Battle Groups



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